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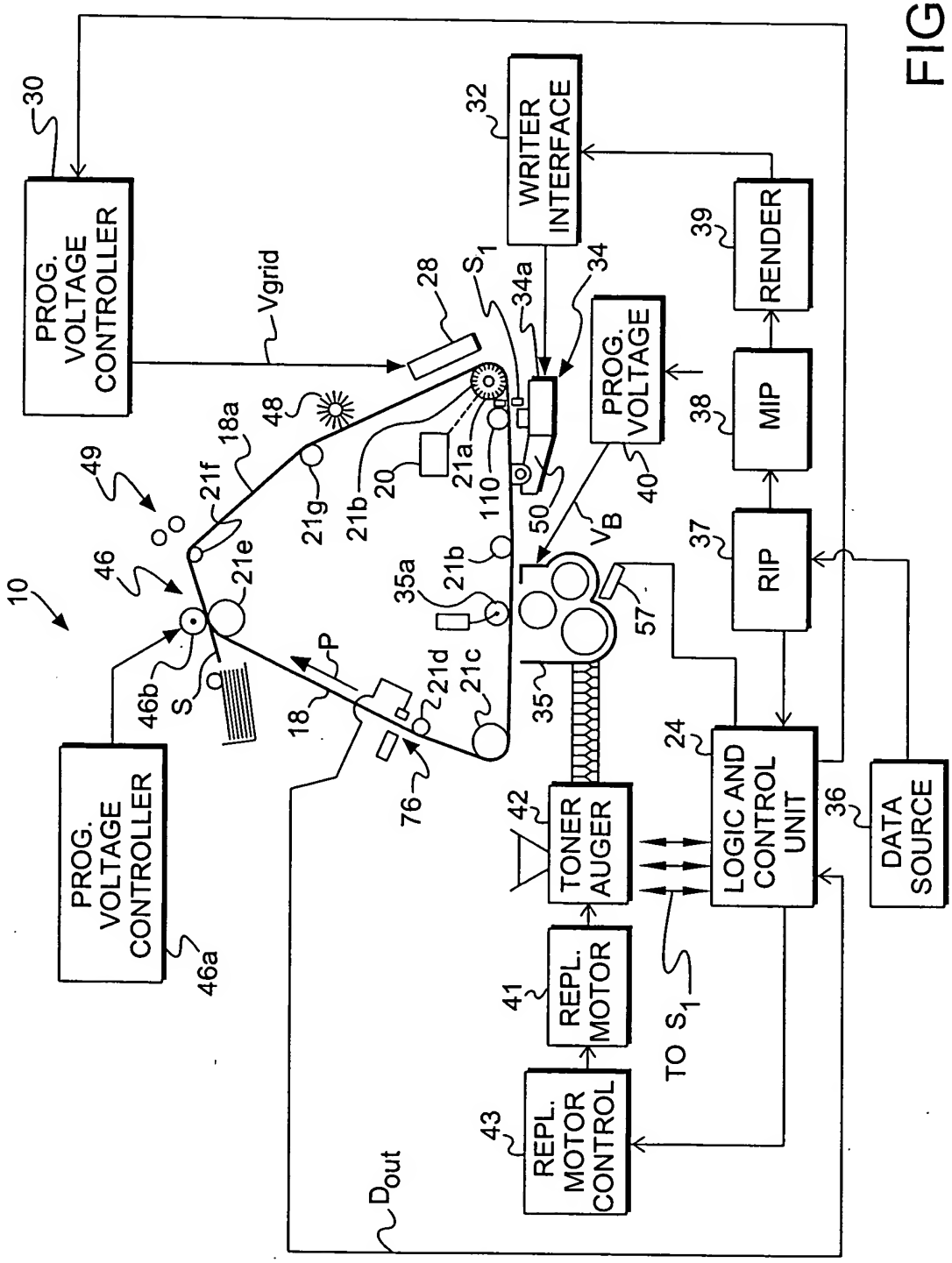

10
30
PROG. VOLTAGE CONTROLLER
Vgrid
28
32
WRITER INTERFACE
S_1
34a
34
PROG. VOLTAGE
39
RENDER
38
MIP
40
V_B
37
RIP
24
LOGIC AND CONTROL UNIT
36
DATA SOURCE
TO S_1
42
TONER AUGER
41
REPL. MOTOR
43
REPL. MOTOR CONTROL
D_{out}
PROG. VOLTAGE CONTROLLER
46a
46b
S
46
49
48
18a
21f
21e
21g
21b
20
21a
110
50
35a
21b
57
35
21d
21c
18
P
76

FIG. 1a

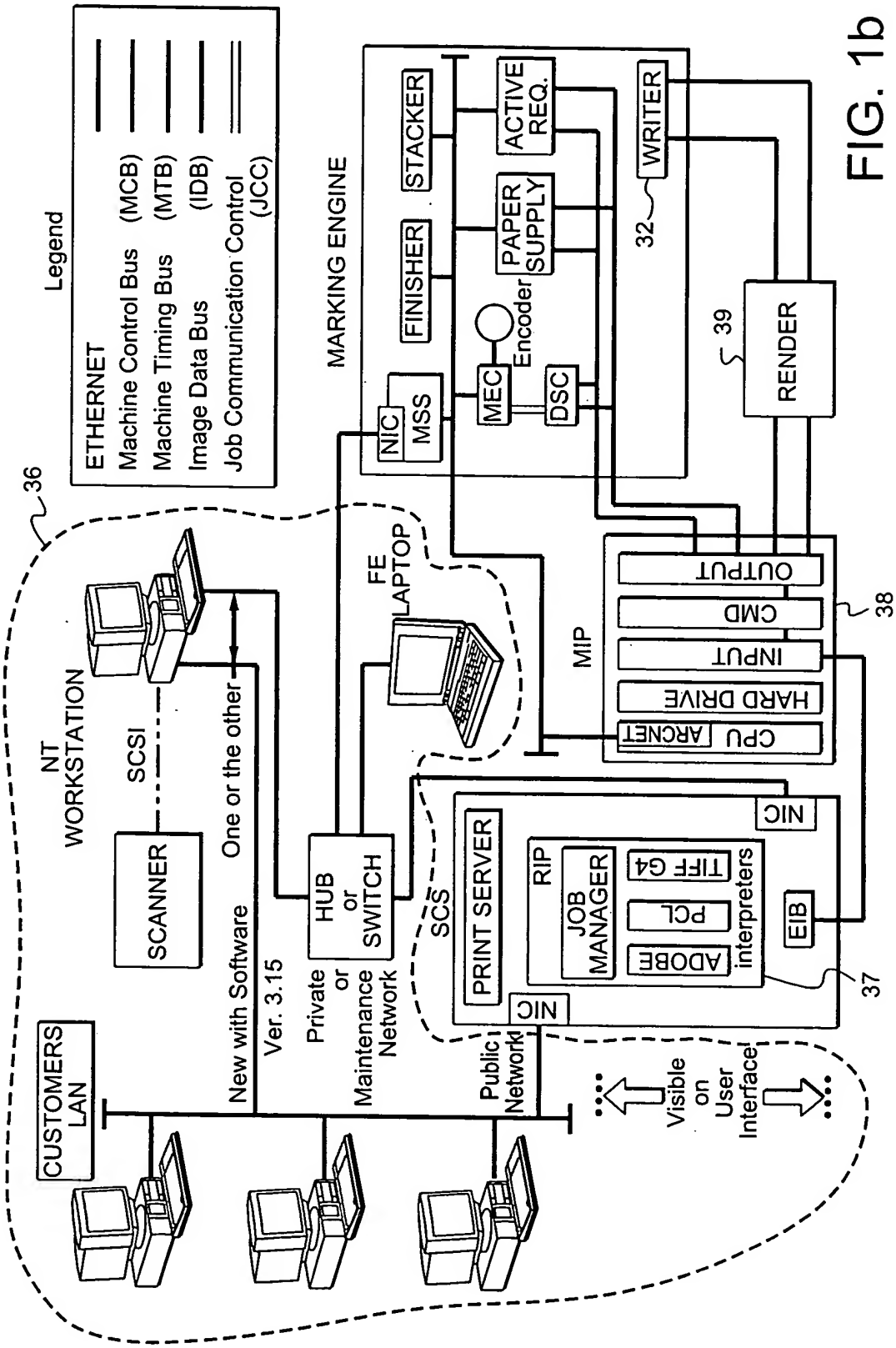

Legend
ETHERNET
Machine Control Bus (MCB)
Machine Timing Bus (MTB)
Image Data Bus (IDB)
Job Communication Control (JCC)
36
MARKING ENGINE
NIC
MSS
MEC
Encoder
DSC
FINISHER
STACKER
PAPER SUPPLY
ACTIVE REQ.
WRITER
32
39
RENDER
FE LAPTOP
MIP
OUTPUT
CMD
INPUT
HARD DRIVE
CPU
ARCNET
38
NT WORKSTATION
SCSI
SCANNER
One or the other
New with Software
Ver. 3.15
HUB or SWITCH
Private or Maintenance Network
SCS
PRINT SERVER
RIP
JOB MANAGER
TIFF G4
PCL
ADOBE interpreters
EIB
NIC
NIC
37
CUSTOMERS LAN
Public Network
Visible on User Interface

FIG. 1b

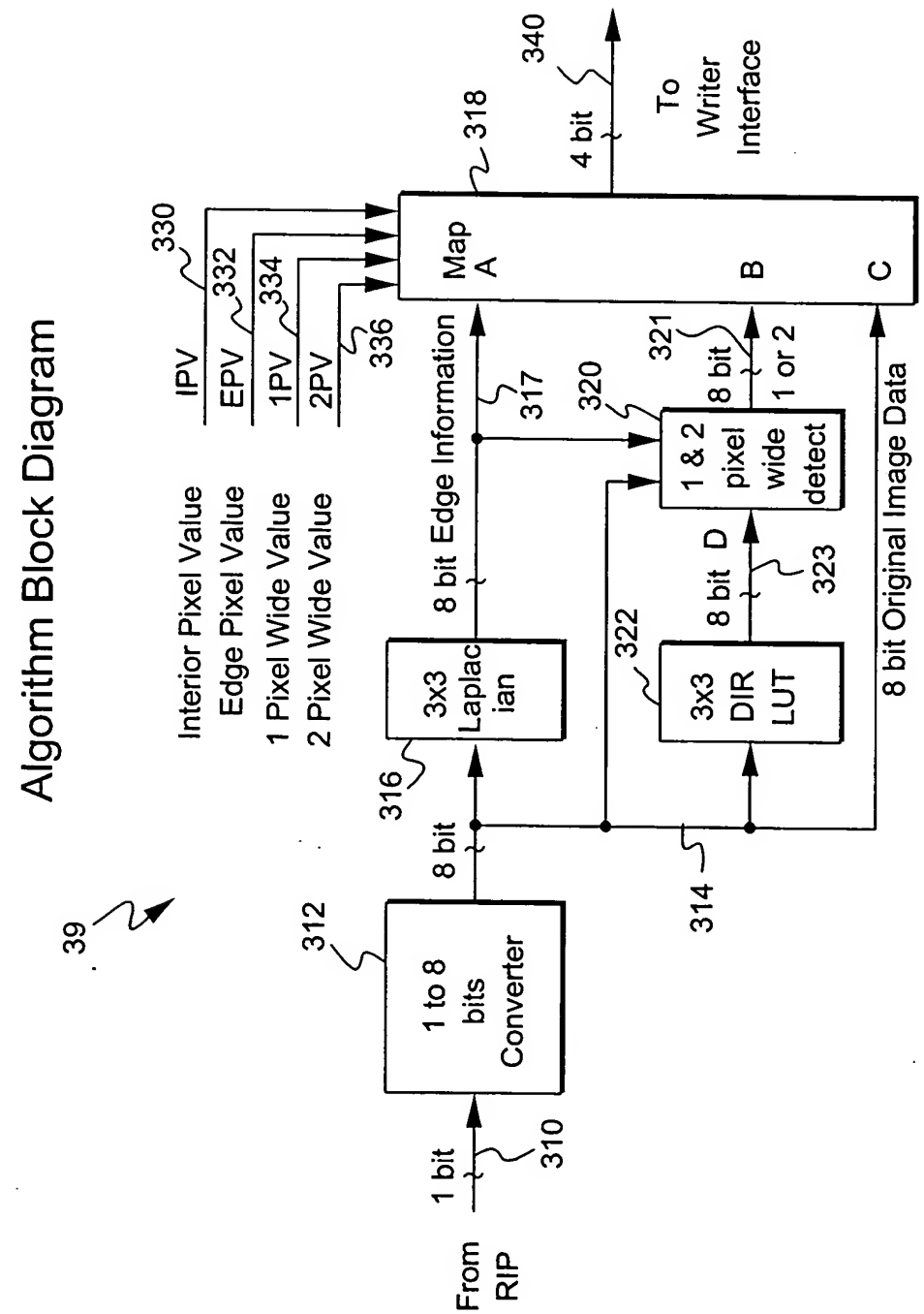

Algorithm Block Diagram
39
From RIP
1 bit
310
1 to 8 bits Converter
312
8 bit
314
3x3 Laplacian
316
8 bit Edge Information
317
3x3 DIR LUT
322
8 bit D
323
1 & 2 pixel wide detect
320
8 bit
321
1 or 2
8 bit Original Image Data
Interior Pixel Value
Edge Pixel Value
1 Pixel Wide Value
2 Pixel Wide Value
IPV
EPV
1PV
2PV
330
332
334
336
Map A
B
C
318
4 bit
340
To Writer Interface

FIG. 2

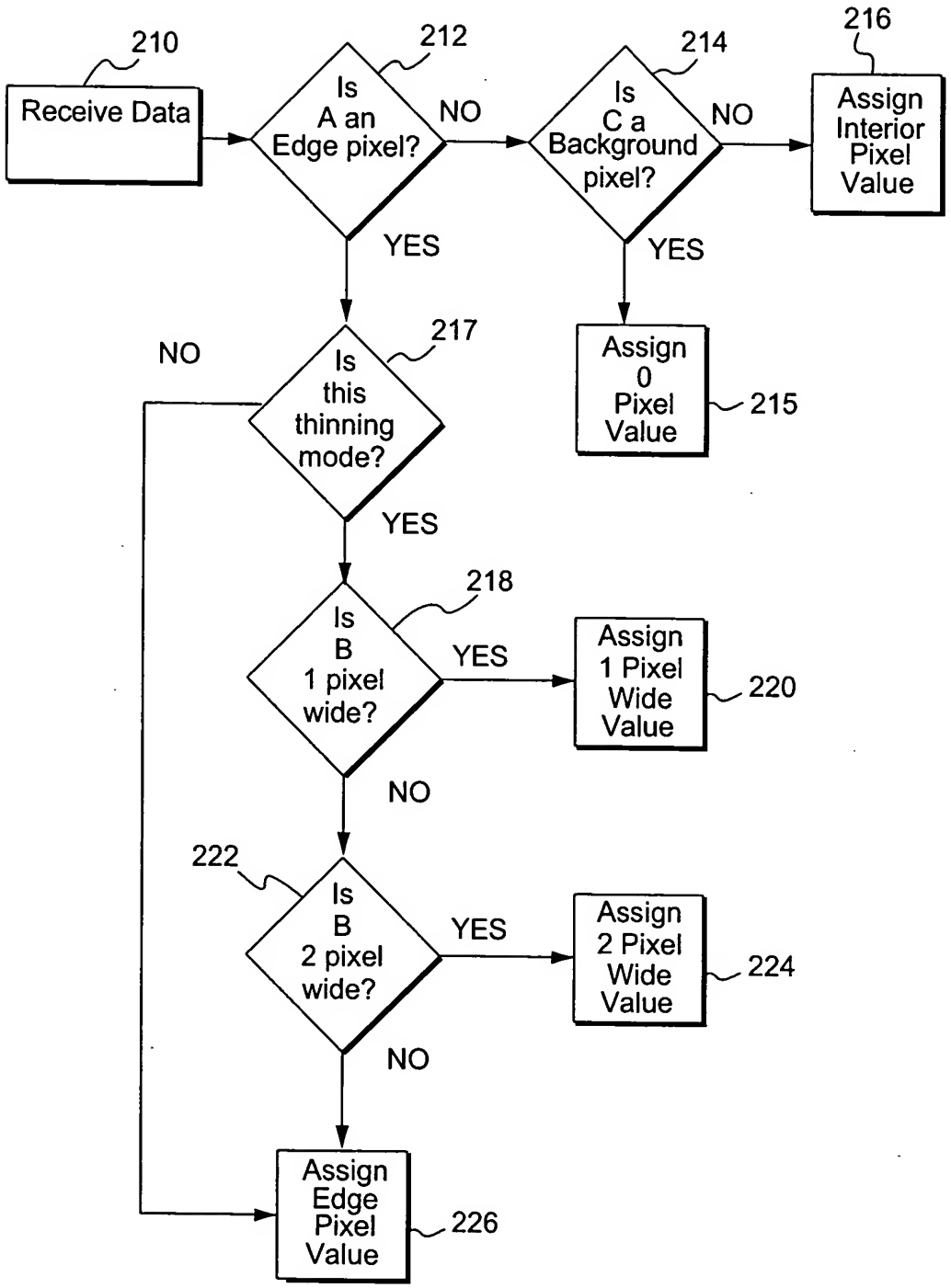
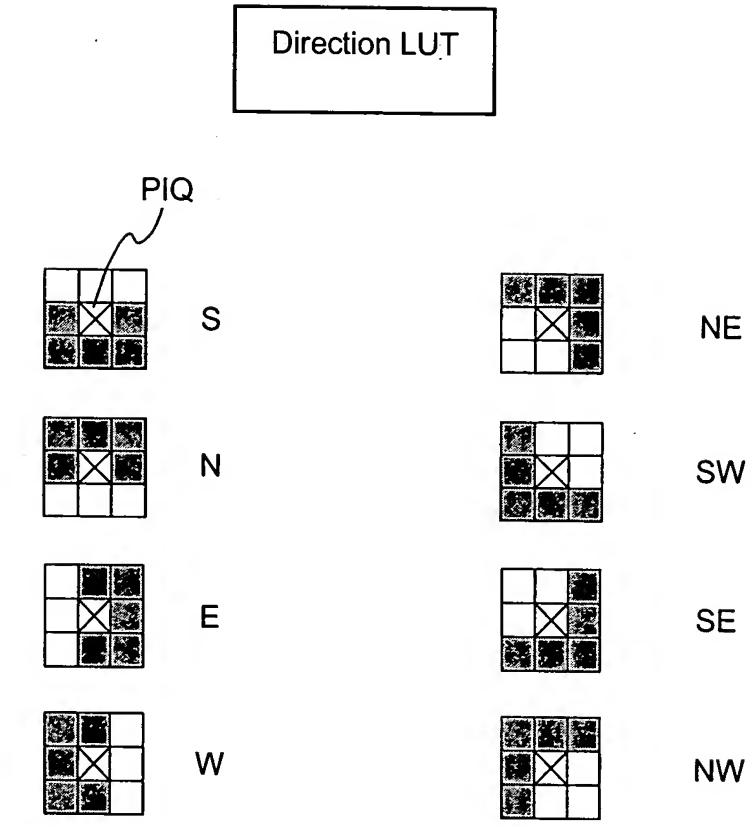

210
Receive Data
212
Is A an Edge pixel?
NO
214
Is C a Background pixel?
NO
216
Assign Interior Pixel Value
YES
YES
217
Is this thinning mode?
NO
Assign 0 Pixel Value
215
YES
218
Is B 1 pixel wide?
YES
Assign 1 Pixel Wide Value
220
NO
222
Is B 2 pixel wide?
YES
Assign 2 Pixel Wide Value
224
NO
Assign Edge Pixel Value
226

FIG. 3



All other combinations result in zero.

FIG. 4

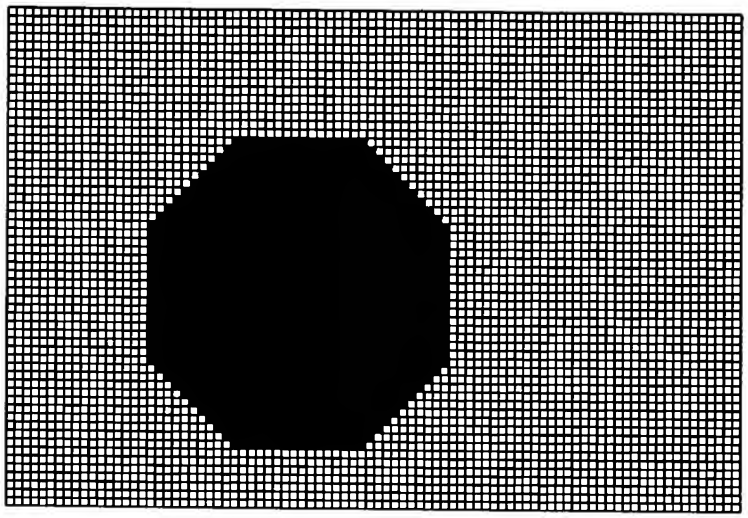

Original object
bitmap

FIG. 5a

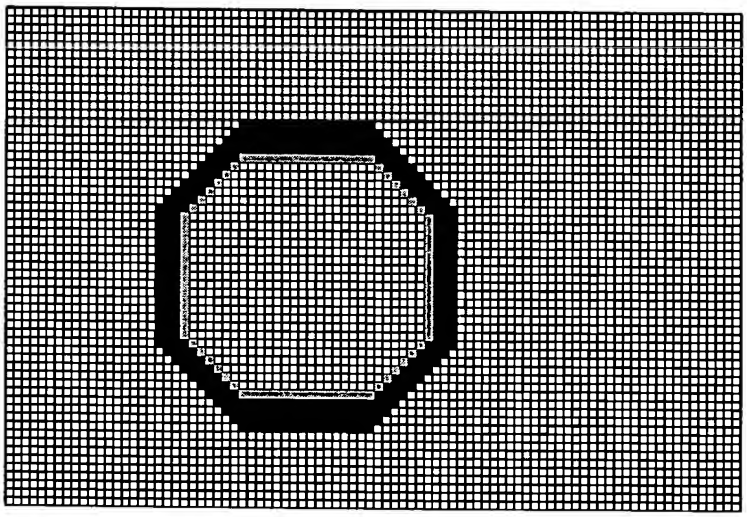

Four onion skin
layers when thinning

FIG. 5b

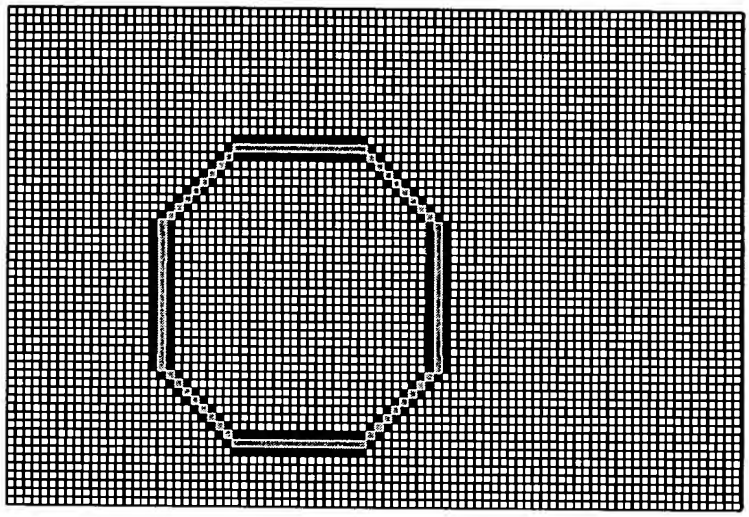

Three onion
skin layers when
thickening

FIG. 5c

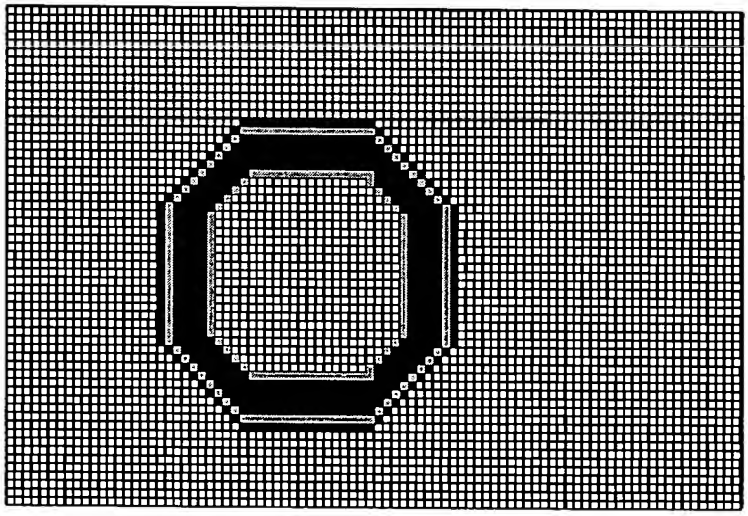
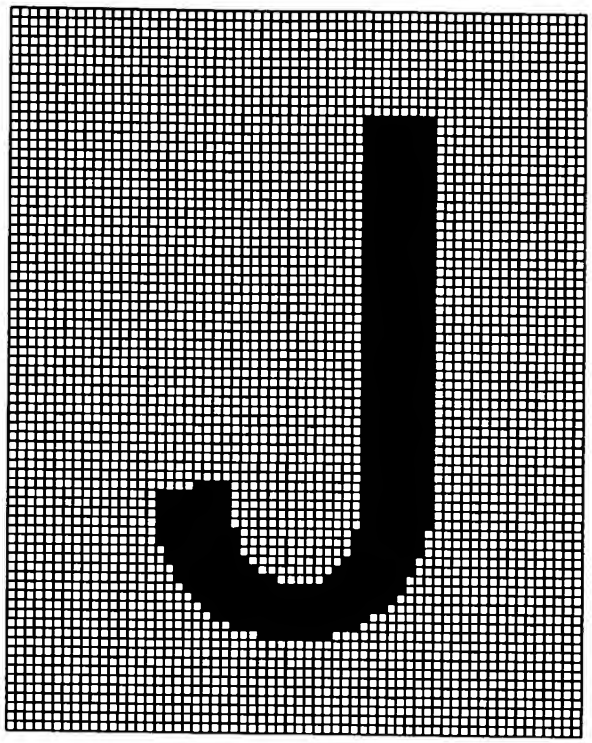
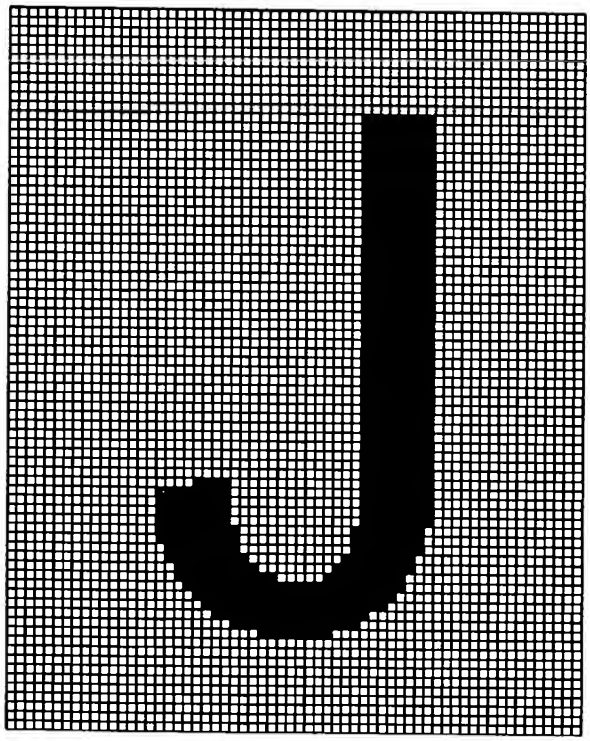

All layers
(thickening and
thinning)

FIG. 5d



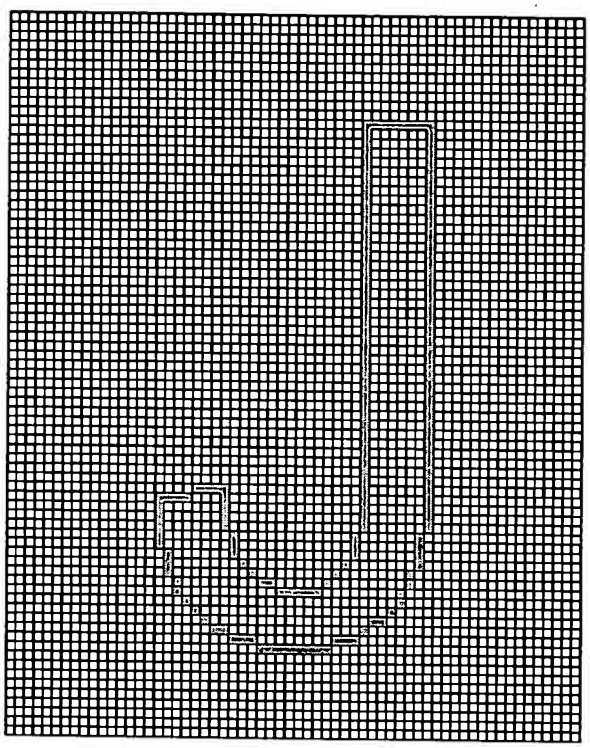
Original
Binary Bitmap

FIG. 6a



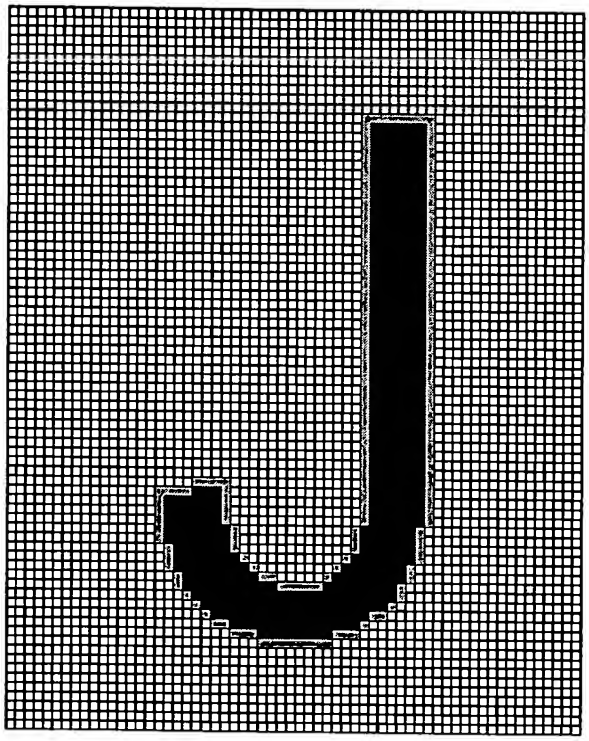
Same grey level pixel value
value assigned to edges
and solid area density

FIG. 6b



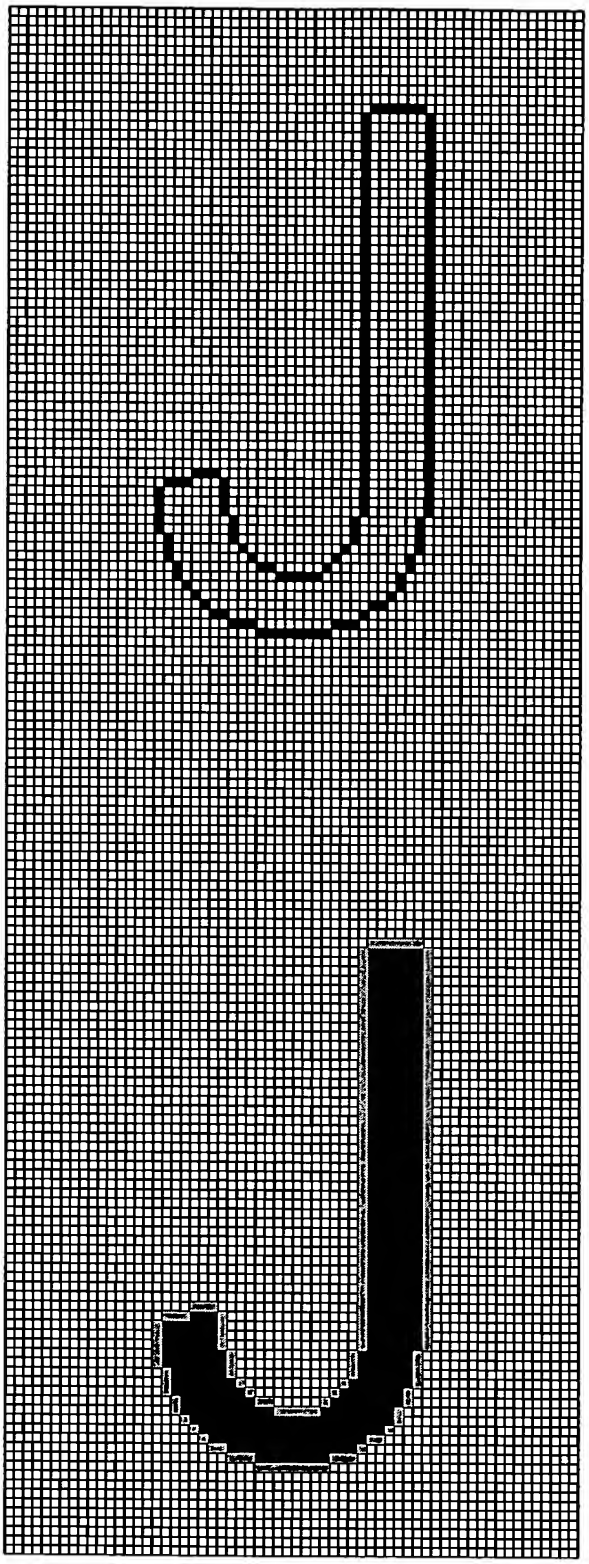
Edges
when thinning

FIG. 6c



Lightened-
Solid area density reduced
Letter thinner

FIG. 6d



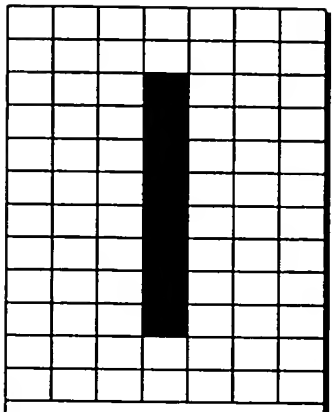
Edges
when thickening

FIG. 6e

Thickened
Letter thickened by applying gray to edges which were originally white

FIG. 6f

1 Pixel Wide Detection



Original 1 pixel wide line

FIG. 7a

0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Edge Pixels

FIG. 7b

0	0	0	0	0	0	0
0	0	SE	S	SW	0	0
0	0	E	S	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	N	W	0	0
0	0	NE	N	NW	0	0
0	0	0	0	0	0	0

Direction Values

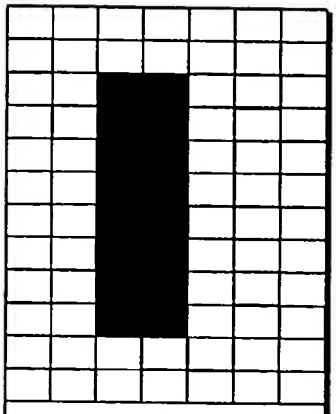
FIG. 7c

BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	EP	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	EP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP

Assignment
BP: Background Pixel
EP: Edge Pixel
1W: One Pixel Wide Line

FIG. 7d

2 Pixel Wide Detection



Original 2 pixel wide line

FIG. 8a

0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Edge Pixels

FIG. 8b

0	0	0	0	0	0	0
0	SE	S	S	SW	0	0
0	E	SE	SW	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	NE	NW	W	0	0
0	NE	N	N	NW	0	0
0	0	0	0	0	0	0

Direction Values

FIG. 8c

BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	EP	EP	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	EP	EP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP

Assignment
BP: Background Pixel
EP: Edge Pixel
2W: Two Pixel Wide Line

FIG. 8d

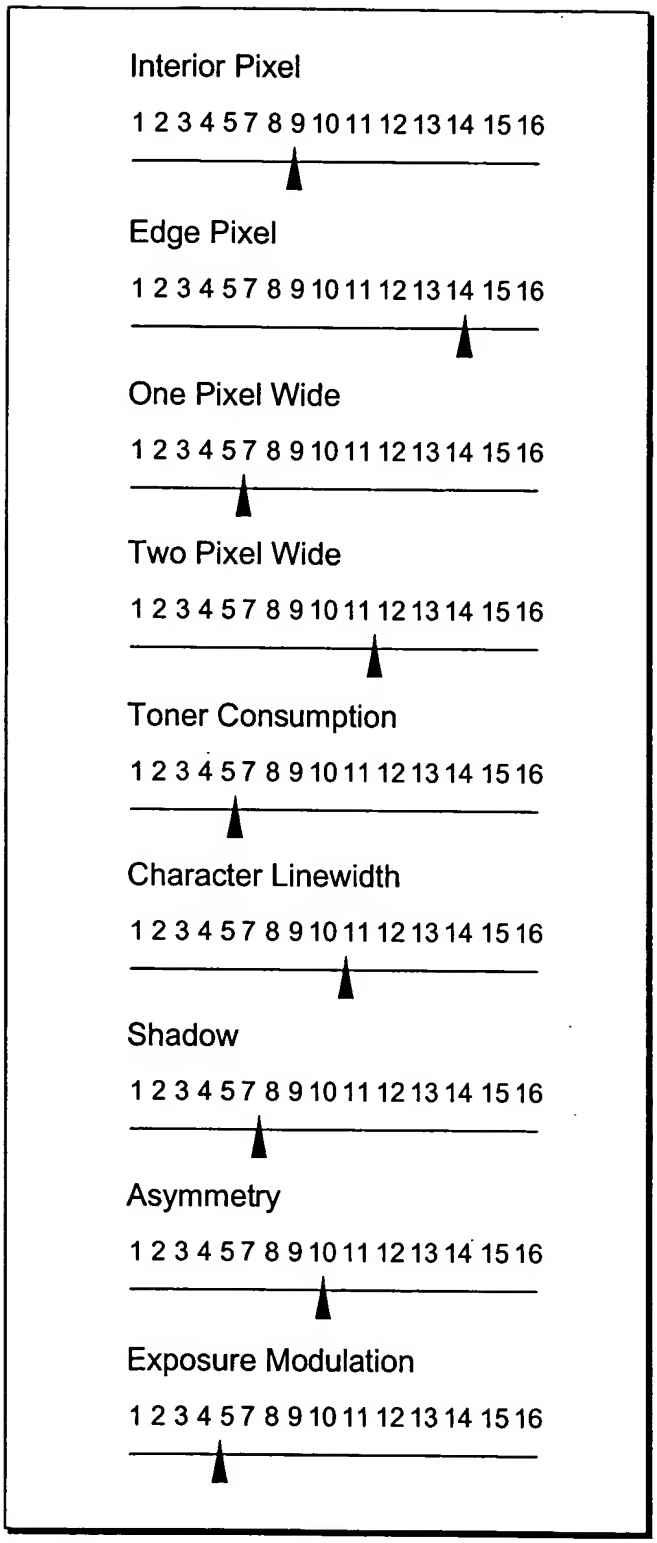

Interior Pixel
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Edge Pixel
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
One Pixel Wide
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Two Pixel Wide
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Toner Consumption
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Character Linewidth
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Shadow
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Asymmetry
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16
Exposure Modulation
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

FIG. 9

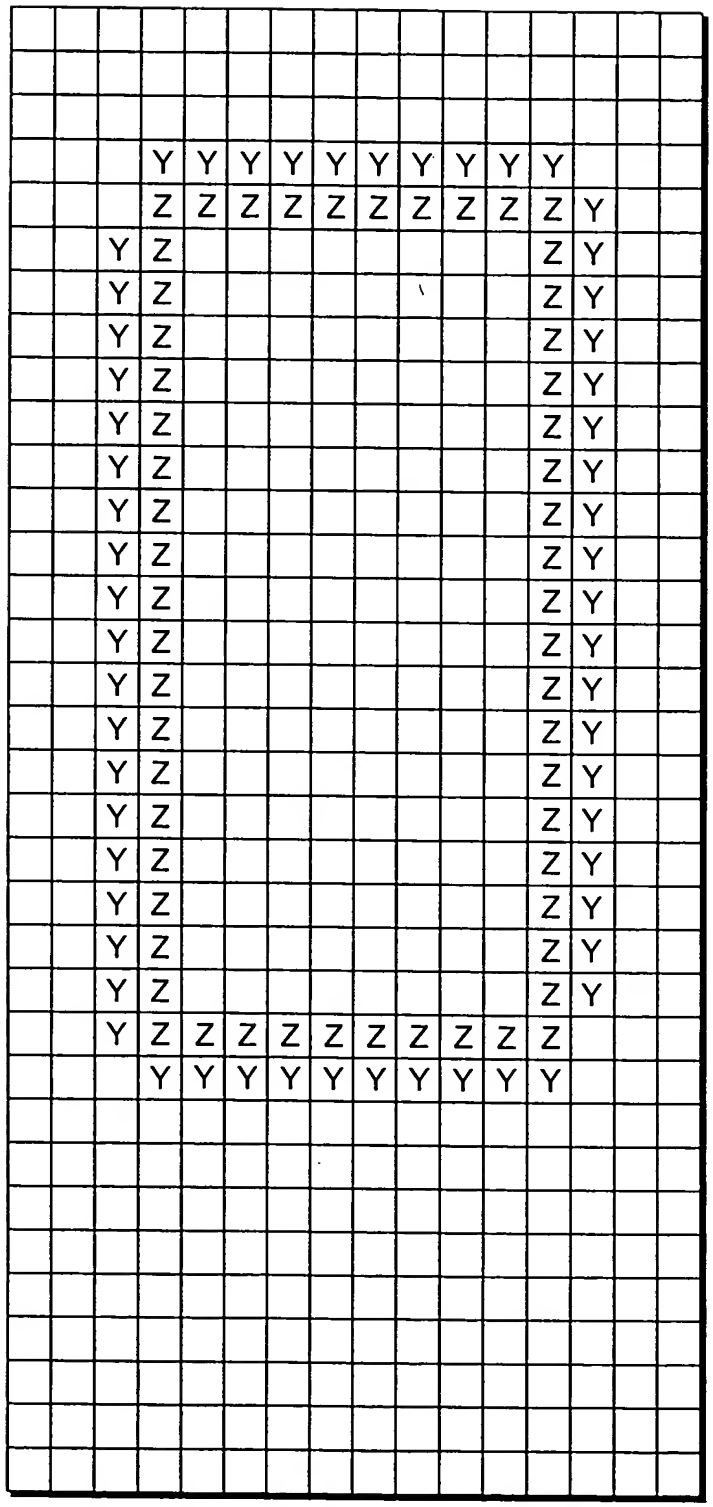

Y Y Y Y Y Y Y Y Y Y
Z Z Z Z Z Z Z Z Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Y
Y Z Z Z Z Z Z Z Z Z Z
Y Y Y Y Y Y Y Y Y Y

FIG. 10

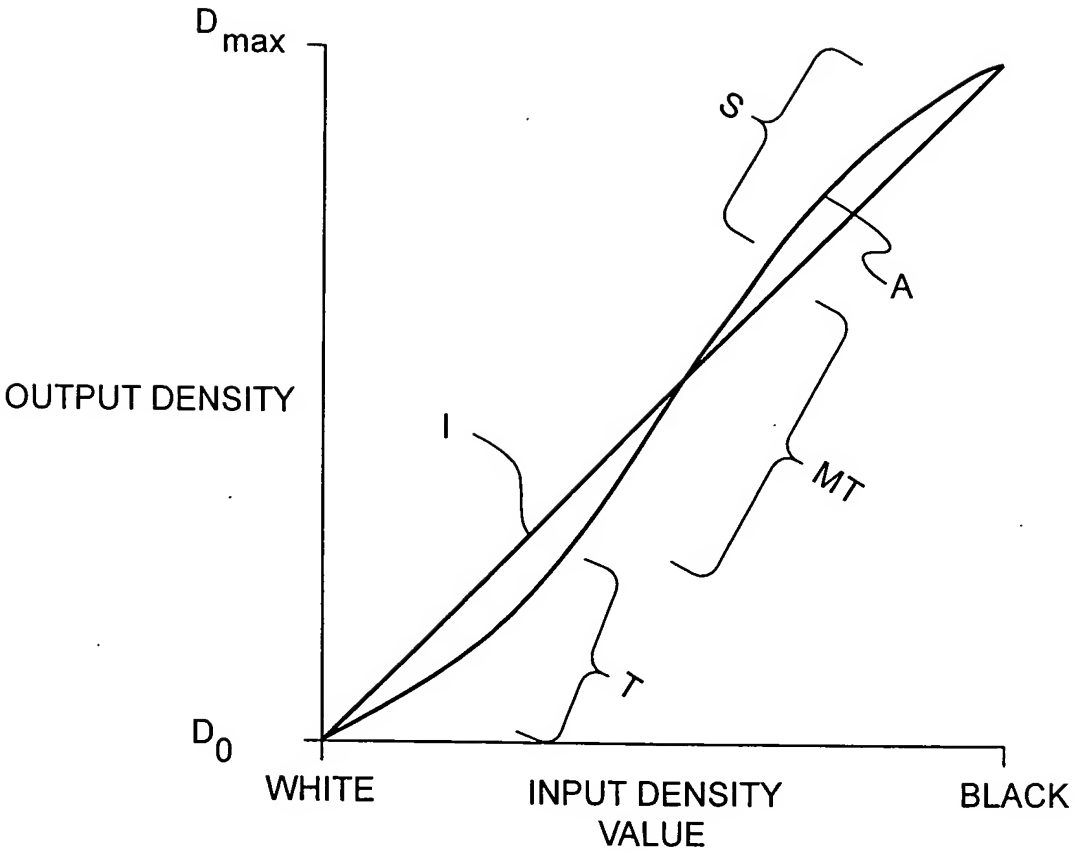

D max
S
A
OUTPUT DENSITY
I
MT
T
D0
WHITE
INPUT DENSITY VALUE
BLACK

FIG. 11

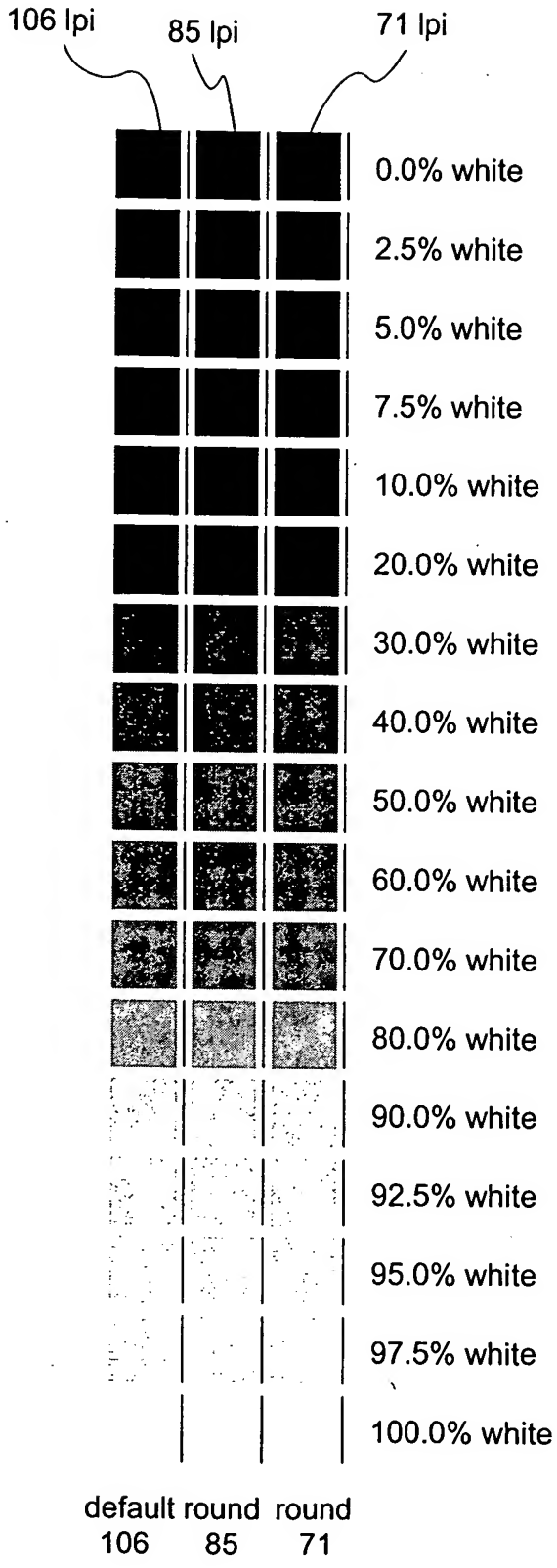

106 lpi
85 lpi
71 lpi
0.0% white
2.5% white
5.0% white
7.5% white
10.0% white
20.0% white
30.0% white
40.0% white
50.0% white
60.0% white
70.0% white
80.0% white
90.0% white
92.5% white
95.0% white
97.5% white
100.0% white
default round 106
round 85
round 71

FIG. 12

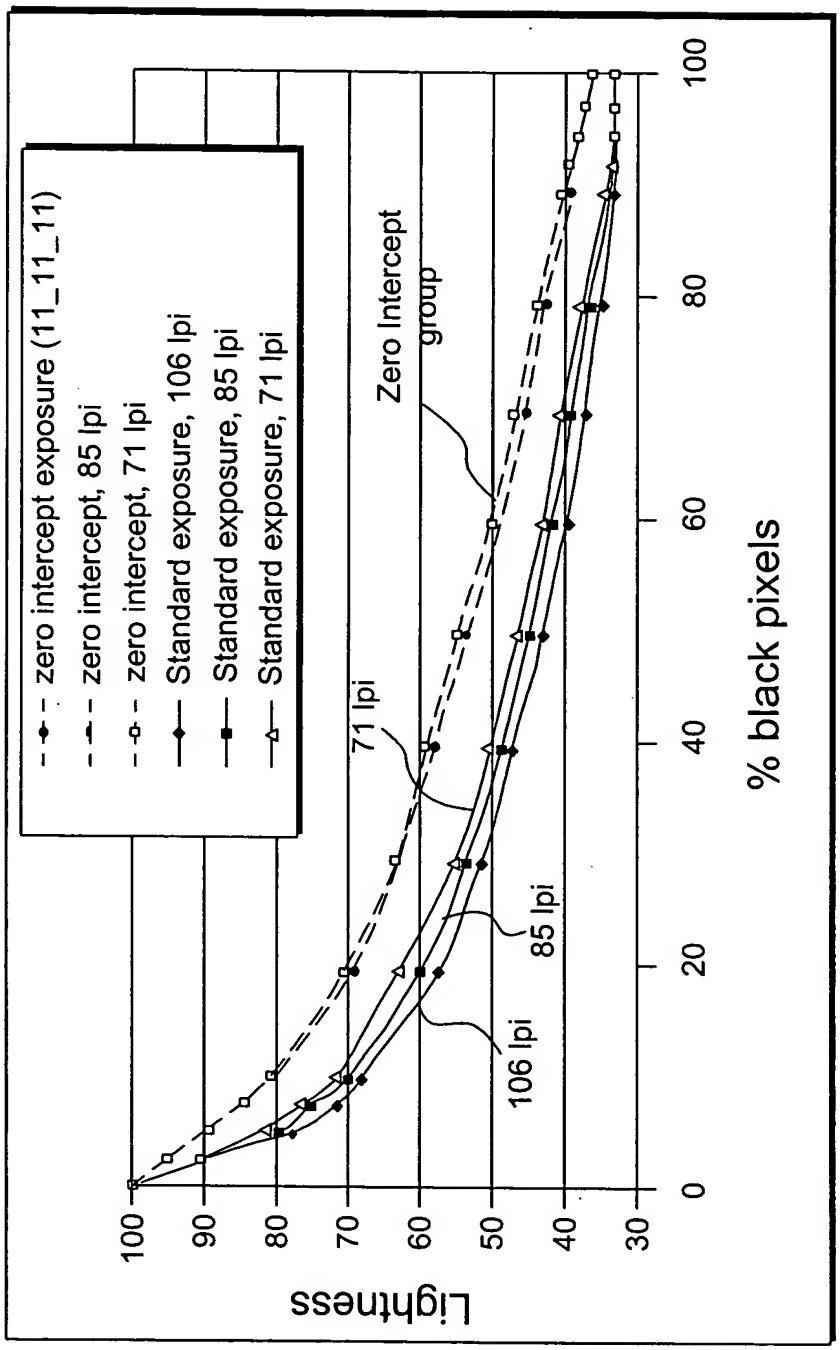

zero intercept exposure (11_11_11)
zero intercept, 85 lpi
zero intercept, 71 lpi
Standard exposure, 106 lpi
Standard exposure, 85 lpi
Standard exposure, 71 lpi
Zero Intercept group
71 lpi
85 lpi
106 lpi
Lightness
% black pixels
100
90
80
70
60
50
40
30
0
20
40
60
80
100

FIG. 13

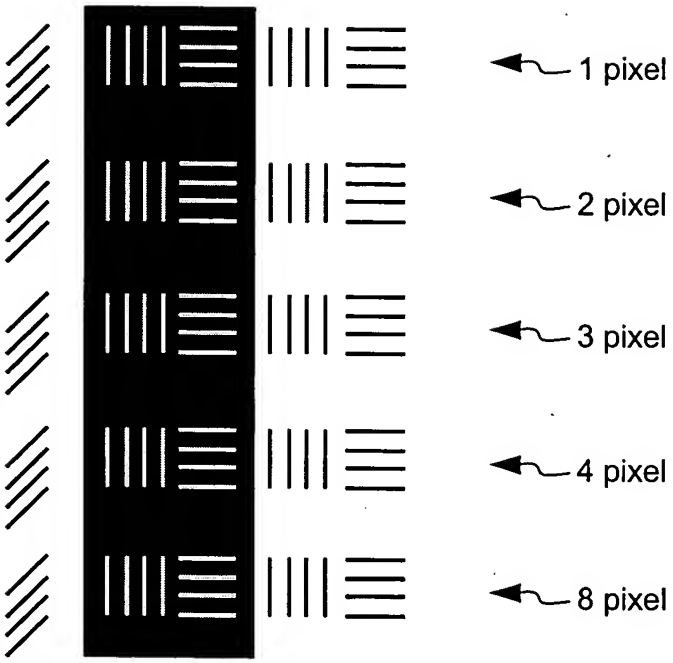


FIG. 14

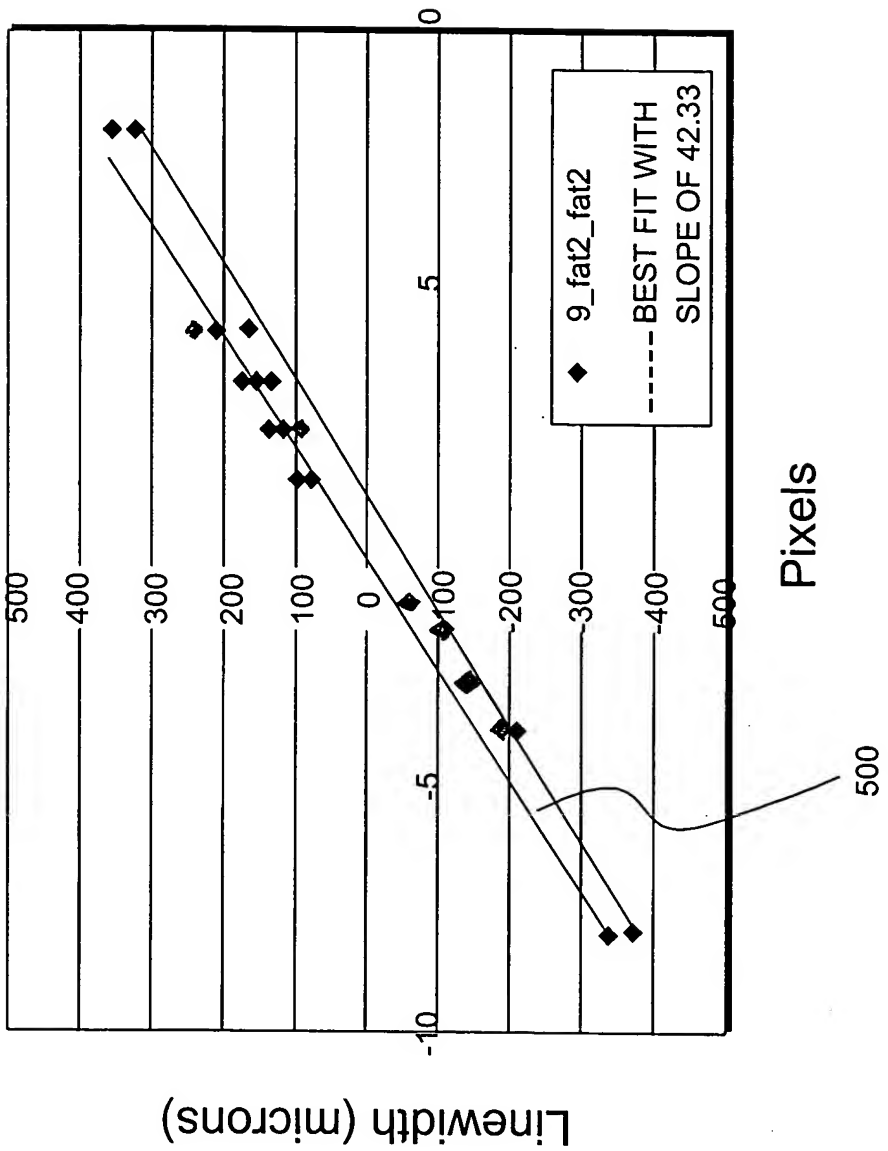

Linewidth (microns)
500
400
300
200
100
0
-10
0
5
-5
100
-200
-300
-400
500
Pixels
9_fat2_fat2
BEST FIT WITH
SLOPE OF 42.33

FIG. 15

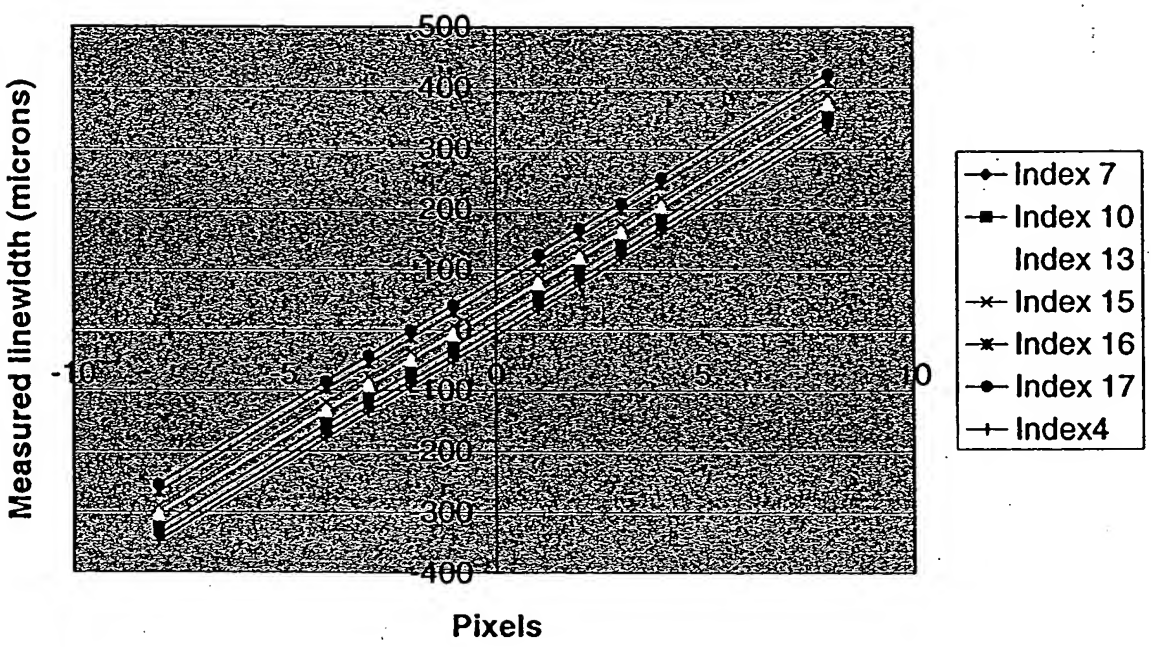

Measured linewidth (microns)
500
400
300
200
100
0
-100
-200
-300
-400
-10
-5
0
5
10
Pixels
Index 7
Index 10
Index 13
Index 15
Index 16
Index 17
Index4

Fig. 16

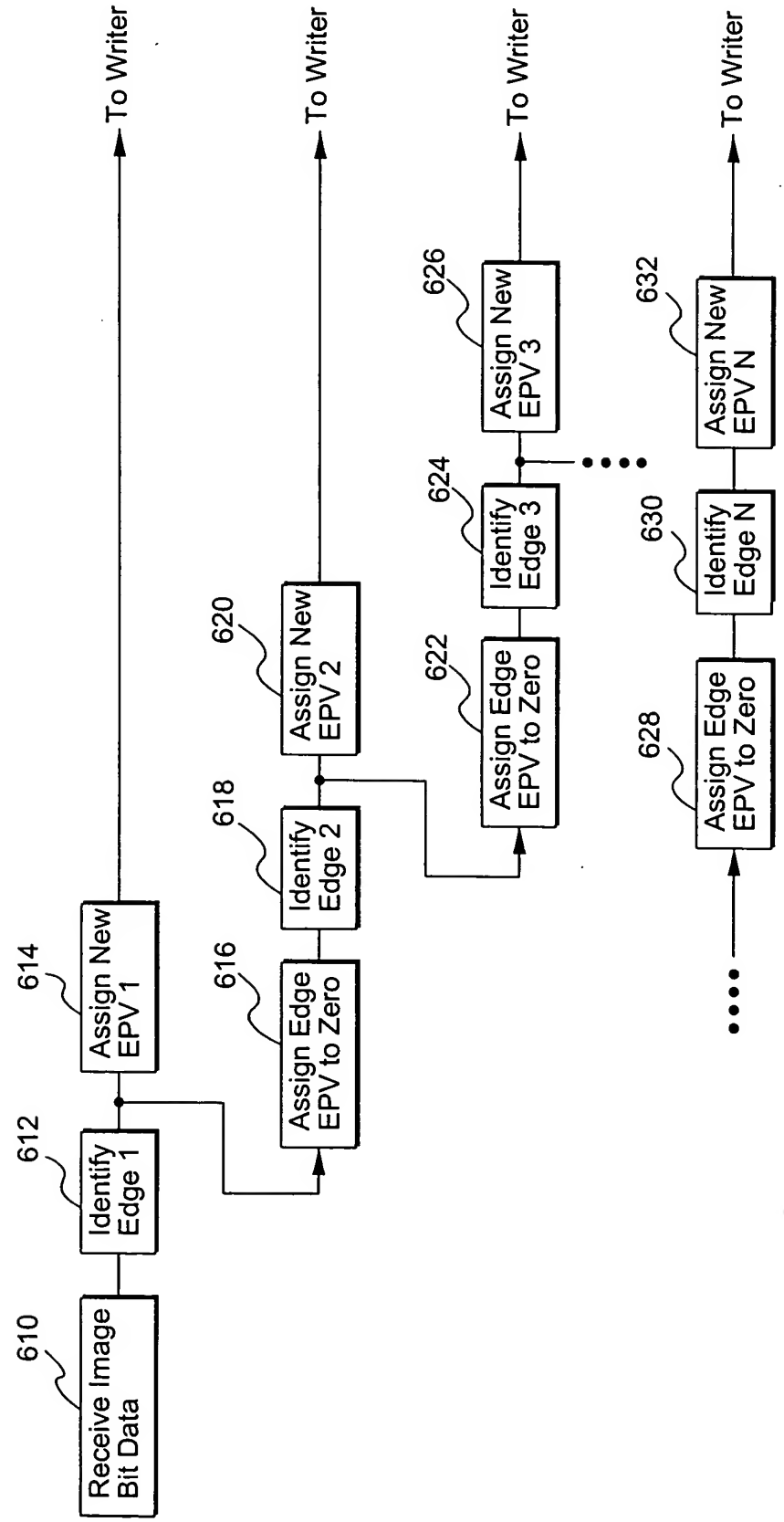

Receive Image Bit Data
610
Identify Edge 1
612
Assign New EPV 1
614
To Writer
Assign Edge EPV to Zero
616
Identify Edge 2
618
Assign New EPV 2
620
To Writer
Assign Edge EPV to Zero
622
Identify Edge 3
624
Assign New EPV 3
626
To Writer
Assign Edge EPV to Zero
628
Identify Edge N
630
Assign New EPV N
632
To Writer

FIG. 17